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Woodward-Clyde Consultants

July 26, 1985
84C2074

Browning-Ferris Industries, Inc.
East Central Region
1800 Parkway Drive
Hanover, MD 21079

Attention: Mr. David F. White
Regional Landfill Manager

SOUTH BRUNSWICK LANDFILL COVER CERTIFICATION SOUTH BRUNSWICK, NEW JERSEY

Gentlemen:

Woodward-Clyde Consultants (WCC) is pleased to submit our final construction report for field inspection services provided during 1984-1985 for the landfill closure activities at the South Brunswick Landfill, South Brunswick Township, New Jersey. The initial laboratory study to characterize the cover soil was conducted during April and May 1984, and results of this laboratory study were submitted to Browning-Ferris Industries, Inc. (BFI) in our report dated May 21, 1984. The laboratory testing and field inspection services were performed in general accordance with our Addendum No. 189-01 submitted February 16, 1984. Subsequently, the scope of field inspection service was modified to include field inspection on a daily basis rather than on an as-needed "spot check" basis. This modification of the work scope included both daily field construction control and certification of the landfill cover portion of the final closure plan.

The field inspection of cover construction began on June 5, 1984. On August 3, 1984, the scope of work was modified to provide full-time field inspection services. These services continued on a nearly full-time basis until January 4, 1985, at which time, work was stopped due to weather conditions. The project was resumed on April 12, 1985 and completed on July 11, 1985. The field inspection personnel associated with this project include Mr. Joseph Battista, Mr. Gary Sheehan, Mr. Carl Streck, and Mr. Hannibal Joma. Mr. Craig R. Calabria served as the Project Manager. A Summary of the

Consulting Engineers, Geologists
and Environmental Scientists

Offices in Other Principal Cities

453901



closure criteria and a description of the work completed for the cover program are presented in the following paragraphs. The work completed is schematically shown on Plate 1. In-place field density test results, laboratory coefficient of permeability, and topsoil test data are presented in Appendices A, B, and C, respectively.

CLOSURE COVER CRITERIA

The criteria governing the final cover placement as part of the South Brunswick Landfill closure were established in a report prepared by Wehran Engineering entitled "South Brunswick Township Landfill Remedial Action Plan, Addendum, September 1983." Those sections of the above-cited report which were applicable to the cover program for the closure of the subject landfill were presented in WCC's report dated April 8, 1985, together with the applicable New Jersey State Highway Department Standard Specifications. The selection of, design intent, and design standards for the final cover program were also presented in the above-referenced report.

FIELD ENGINEERING

As requested by BFI, the initial proposed scope of work was modified from periodic visits to full-time daily inspection in order to provide sufficient data to facilitate preparation of a letter of certification for submittal to the regulatory agency. In addition to providing the certification data, the expanded daily work scope provided quality control services for the landfill cover program, which included placement and spreading of the clay cover, sand blanket, and topsoil materials, as well as final seeding. A WCC representative (resident field engineer/geologist/technician) was present during most of the final cover operations after August 3, 1984 to observe, document, and test the constructed final cover layers for adherence to the governing criteria established in the referenced closure plan. The following is a summary of construction operations outlining the services provided by WCC from April to July 1985. For a complete description of the field engineering services, see WCC's report dated April 8, 1985.

CLAY COVER MATERIAL

The quality of the incoming clay cover material was visually monitored in order to determine if the material was of sufficient quality to be a suitable cover material. The clay was inspected for moisture content, plasticity, silt, sand, and gravel content. On occasion, the field inspector, judging that the clay material was of poor quality, rejected the subject loads. In addition, subsequent trips were made to the borrow pit as necessary, and the zones of unacceptable material were more clearly identified. The borrow pit operator was instructed to avoid the suspect areas when shipping clay material to the site.

The clay lift thickness was monitored using a hand probe in order to document a minimum uncompacted in-place thickness of 13 to 16 inches. The field inspector also conducted in-place field and moisture-content tests on the compacted clay cover at a frequency of 3 to 4 tests per acre. The locations of these tests are shown on Plate 1, and the test results are presented in Appendix A.

The drive cylinder density test method was used to determine bulk density, and Speedy moisture meter tests were used to determine the apparent field moisture content for field quality control purposes. Samples of the tested materials were secured and maintained in airtight containers for laboratory moisture-content testing. The results of these field moisture-density tests were compared to relationships developed in the previously completed laboratory investigations described in our report dated May 21, 1984. The data presented in this report were initially used as guidelines for a compaction control. As described in our May 21, 1984 report, the recommended degree of compaction is moisture-dependent and is as follows:

<u>Moisture Content</u> <u>Range %</u>	<u>Minimum Compaction</u> <u>%</u>
27-29	93
29-31	90
31-34	88

The field inspector made the appropriate recommendations for corrective action where test results were beyond the limits established in the May 21 report. For example, recompaction would be recommended for test locations showing moisture content in the range of 27 to 29 percent with a relative compaction of less than 93 percent. After recompaction, the deficient areas were retested to determine if they complied with the established criteria for acceptance.

Shelby tube samples of the compacted clay layer were secured from the site, using one sample per covered acre as a basis. The undisturbed samples were tested for density, moisture content, and coefficient of permeability. Based upon the results of the laboratory permeability testing, the area represented by the undisturbed sample was either approved or not approved. For the areas not approved, the appropriate recommendations were made for corrective action to improve these unapproved areas sufficiently to satisfy the established criteria. As more undisturbed sampling tests became available, a more refined relationship between the compaction control criteria (dry unit weight, moisture content, and the desired coefficient of permeability) was developed. Thus, the compaction control criteria were modified accordingly to accommodate the results of the new test data. Results of the 69 undisturbed samples tested are presented graphically on Plate 2. As can be seen, there is a relationship between the moisture content, dry unit weight, and coefficient of permeability. Thus, based upon an analysis of this data, the required coefficient of permeability of 1×10^{-7} cm/sec has been achieved with more than a 95-percent probability of success, since the dry density and moisture content are within the range shown on Plate 2. An interpretation of Plate 2 is further explained in WCC Report 84C2074, dated December 8, 1984. Laboratory results of the coefficient of permeability are presented in Appendix B.

The WCC field inspector also conducted monitoring of areas which were completed and approved, but exposed for extended periods. Conditions of desiccation and erosion were noted, as well as apparent gas and water leaks from the exposed clay cover materials. Recommendations for remediation of desiccation cracks, erosion, and/or leaks were made as necessary and usually involved either recompaction of the clay cover with the addition of more clayey materials as necessary. Completed areas determined to be in compliance with the regulations were then approved for sand and topsoil cover.

SAND

The field inspector visually monitored the quality of the incoming sand for compliance with the project requirements. Recommendations were made regarding the suitability of the sand in accordance with the governing criteria previously cited from the Wehran report. Sand from two borrow sources have been used at the site to date. The first consisted of a light brown silty fine sand with occasional inclusions of silty clay (Type I); the second consisted of orange brown to tan gravelly silty coarse to fine sand (Type II). Sand material delivered to the site that had excessive silty clay material was rejected or the silty clay portion (usually occurring as nodules) of the material was culled out and separated from the sand blanket material. The field inspector monitored the lift thickness of the sand by hand-probing. The sand thickness was generally kept within the range of 6 to 8 inches. Recommendations to increase or decrease the thickness of the sand layer were made as appropriate to maintain a minimum 6-inch sand cover.

Field samples of both Type I and II sands being used at the site were secured for laboratory testing in order to determine whether these materials met the criteria established in the Wehran report. The parameters tested for included grain-size distribution and coefficient of permeability. The test results indicated that, while the grain-size distribution requirement had been met, the coefficient of permeability of the prepared reconstituted samples was less than the minimum permeability of 1×10^{-3} cm/sec established in the Wehran report. This discrepancy has been addressed in WCC's report dated November 9, 1984. In summary, the sand functions to provide a buffer layer to protect the clay layer from tears, cracks, and punctures, and to provide a drainage layer to allow a path for water to exit. Based upon the design intent, it is concluded that the sand used at the site is satisfactory for its intended use.

Our field inspector conducted periodic monitoring of the sand blanket, which was completed and approved, but exposed for extended periods. The visual inspection consisted of examining the previously approved areas for evidence of erosion, thus reducing the sand blanket thickness below the required 6-inch minimum. Recommendations were made to remediate the deficiencies (i.e. placement of additional sand), and

corrective measures were taken before covering these areas with the vegetation support layer.

VEGETATION SUPPORT LAYER (TOPSOIL)

The field inspector visually monitored the quality of the incoming topsoil material (vegetation support layer) for grain-size distribution and organic content. Recommendations were made regarding the suitability of these materials for use at the site, in compliance with the criteria established in the Wehran report. The lift thickness of this layer was checked by hand probe, and was generally kept within the range of 6 to 8 inches. Recommendations were made to increase or decrease the thickness as appropriate.

Field samples of the topsoil were secured for laboratory testing in order to document compliance with the criteria set forth in the Wehran report. The parameters tested for included grain-size distribution, organic content, and pH. The test results are presented in Appendix C. In summary, the topsoil materials were found to be in compliance with the project requirements. Periodic inspection of the completed areas covered with topsoil were checked for erosion, gas, and water leaks, as well as vegetation growth.

OBSERVATION AND DOCUMENTATION OF CONSTRUCTION ACTIVITIES

The field inspector observed and documented the onsite construction activities, as discussed above. Daily inspection reports were prepared and submitted to the BFI resident manager on a periodic basis. These inspection reports documented observations and field test results, as well as recommendations for remedial actions and the corrective measures taken.

CLAY COVER MATERIALS

Placement of the clay cover has been essentially completed over the entire site. The only area not covered with clay is the access road from the site entrance

on New Road in the east to approximate coordinates North 6100, East 5500 (based on Wehran Engineers' Coordinate System Drawing Sheet 2 of 8, Project No. 02397131) in the west. This area is shown schematically on Plate 1.

SAND COVER

Sand cover placement over the entire area has been completed, with the exception of the access road (see Plate 1). The sand cover placed has been checked for lift thickness and continuity, and approved.

TOPSOIL

Topsoil and seeding have been completed and approved over the entire site with the exception of the access road, as shown on Plate 1. After the topsoil was placed in the central swale, a geosynthetic netting was placed over the entire length of the swale as an erosion protection measure. In addition other steps in construction of the swale were taken to ensure proper drainage (see Plate 3).

SUMMARY

The field inspection services for the landfill closure activities at the South Brunswick Landfill, South Brunswick Township, New Jersey were completed on July 11, 1985. The scope of the work included providing the certification data, daily quality control services for the landfill cover program (placement and spreading of the clay cover, sand blanket, and topsoil materials), and final seeding. A WCC representative (resident field engineer/geologist/technician) was present during most of the final cover operations to observe, document, and test the constructed final cover layers. Overall, for identifications and laboratory testings, 221 density and moisture content tests and 73 Shelby tubes for permeability tests were collected. Based on the above inspection and testing program, the final cover for the facility was completed in general accordance with the provisions of the closure plan.

If you have any questions regarding this report, please do not hesitate to contact us. We look forward to being of further service to you.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

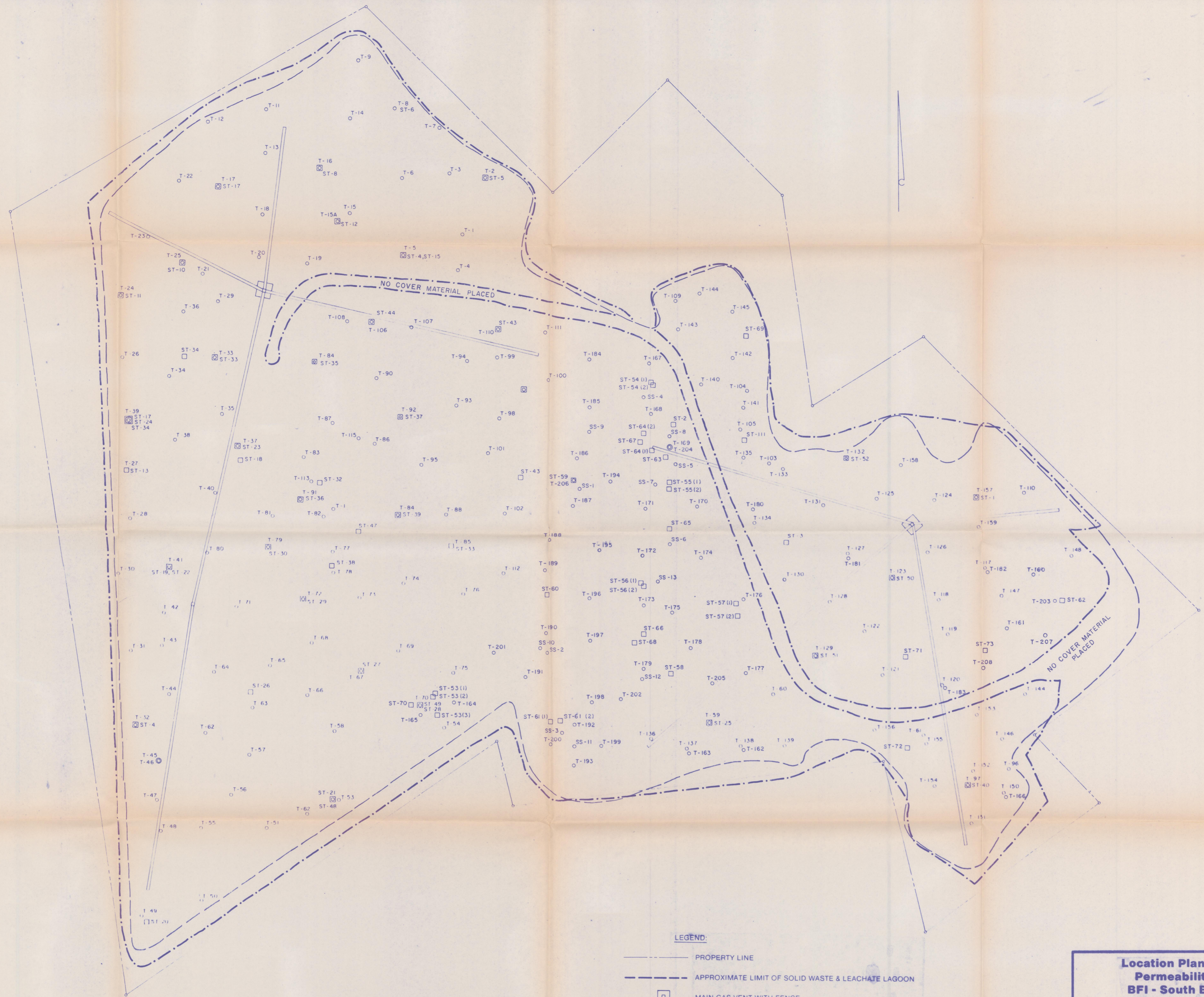
David W. Buggell
for Hannibal Joma
Geologist

Craig R. Calabria
Craig R. Calabria, P.E.
Project Manager

CRC:JCE:plw

cc: Wallace Timmons
Frank Waller
Jeffrey Evans

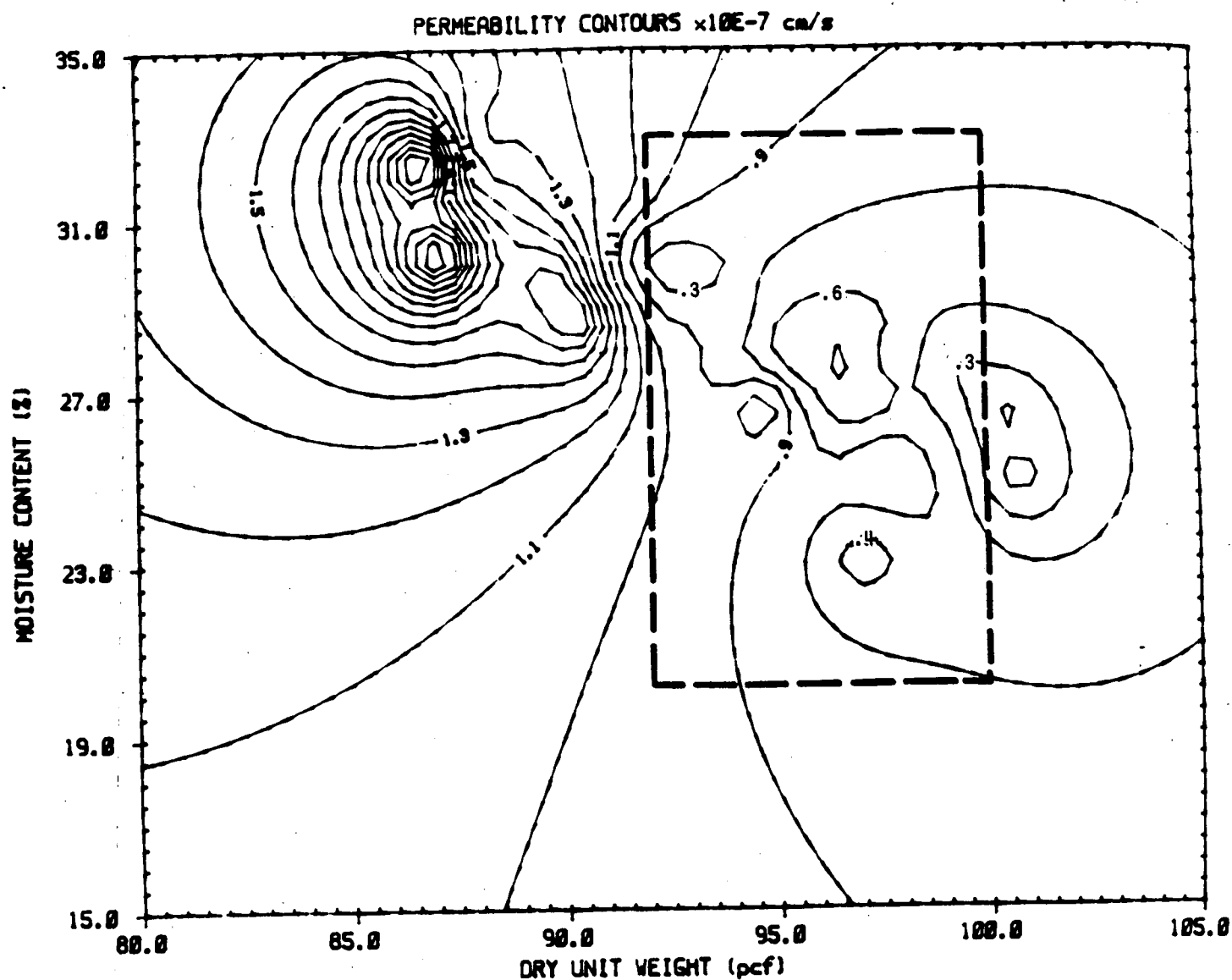
Plates



**Location Plan, Field Density and Permeability Test Locations
BFI - South Brunswick Landfill
South Brunswick, New Jersey**

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T. P.	SCALE 0 150	DATE 5/28/85
CHECKED BY: C. R. C.		DWG. NO. 84C2074

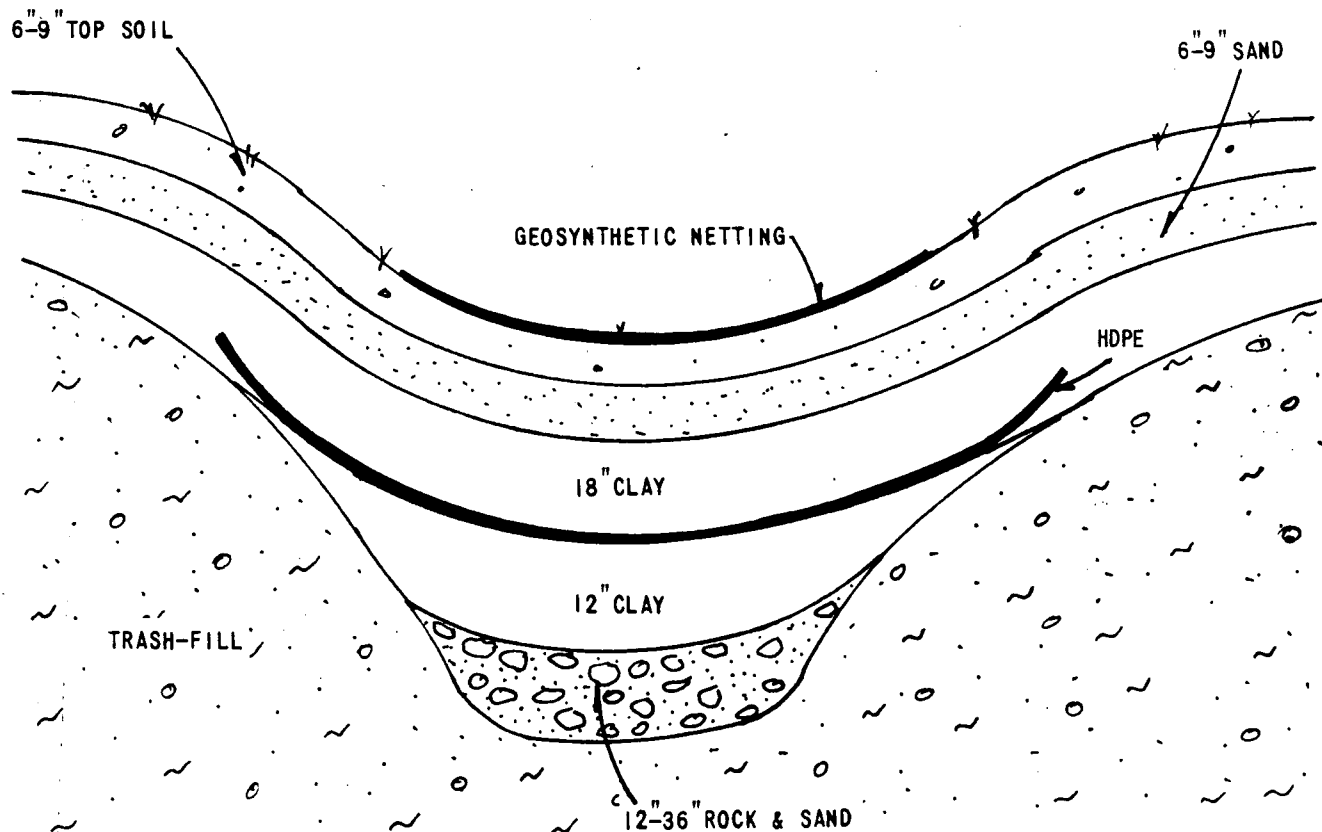


NOTE:

THE AREA BOUNDED BY - - -
REPRESENTS RANGE OF ACCEPTED
VALUES OF DENSITY AND MOISTURE
CONTENT TESTS.

LANDFILL COVER STUDY
BFI-SOUTH BRUNSWICK, N.J.

PLATE 2



NOT TO SCALE

SCHEMATIC CROSS SECTION OF SWALE
BFI-LANDFILL
SOUTH BRUNSWICK NEW JERSEY

84C2074

Appendix A

PROJECT: BFI - S. Brunswick, NJ Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	REMARKS	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-1		Dark gray micaceous organic silty fine sandy clay		26.9					92.7									
T-2				27.1					97.9									
T-3				27.9					95.8									
T-4				31.5					86.4									
T-5				27.1					95.7									
T-6				29.9					89.7									
T-7				29.6					93.7									
T-8				28.4					94.9									
T-9				31.8					90.4									
T-10				27.6					96.1									
T-11				27.6					86.4									
T-12				28.1					97.9									
T-13				31.1					110.1*									
T-14				28.6					88.2									
T-15				23.6					121.8									

* See Test Curves

* Value high retest see T-16 & T-17



PROJECT: BFI - S. Brunswick, NJ Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No	DEPTH (feet)	REMARKS	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYD.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-15A		Dark gray micaceous organic silty fine sandy clay		28.2**					95.7									
T-16				26.2					92.1									
T-17				25.8					95.9									
T-18				27.0					98.4									
T-19				30.3					92.2									
T-20				25.2					101.7									
T-21				23.8					94.1									
T-22				24.1					103.5									
T-23				28.0					97.7									
T-24				28.5					96.3									
T-25				25.2					98.9									
T-26				24.0					98.9									
T-27				25.8					103.0									
T-28				27.8					98.7									
T-30				26.6					97.8									

* See Test Curves

**Speedy moisture test method



PROJECT: BFI - S. Brunswick, NJ Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No	DEPTH (feet)	REMARKS	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAxIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-31		Dark gray micaceous organic silty fine sandy clay		27.1					98.3									
T-32				24.8					99.2									
T-33				27.1					95.3									
T-34				28.0					96.7									
T-35A				28.4					93.5									
T-35B				28.4					100.9									
T-36				27.2					97.7									
T-37				31.7					89.6									
T-38				26.5					94.5									
T-39				31.1					91.4									
T-40				28.0					93.0									
T-41				27.0					95.8									
T-42				26.5					95.0									
T-43				26.9					94.2									
T-44				27.2					94.5									

* See Test Curves



PROJECT: BFI -/S. Brunswick, NJ Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	REMARKS	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-45		Dark gray micaceous organic silty fine sandy clay																
T-46				27.3					94.1									
T-47				29.5					91.1									
T-48				29.8					92.9									
T-49				24.6**					97.7									
T-50				24.2**					94.2									
T-51				24.5**					92.3									
T-52				22.4**					95.6									
T-53				23.4**					96.7									
T-54				30.9					89.2									
T-55				27.4					93.8									
T-56				28.2					94.1									
T-57				27.3					94.7									
T-58				29.5					93.1									
T-59				26.2					95.6									

* See Test Curves

**Speedy moisture test method



PROJECT: BFI - S. Brunswick, NJ Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No	DEPTH (feet)	REMARKS	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-60		Dark gray micaceous organic silty fine sandy clay		27.3						92.9								
T-61				26.7						96.9								
T-62				28.3						92.0								
T-63a				28.9						88.1								
T-63b				23.7						95.4								
T-64				29.7						92.9								
T-65				29.6						89.0								
T-66				26.9						96.8								
T-67				26.9						93.0								
T-68				26.8						95.1								
T-69				28.5						88.3								
T-70				26.0**						93.7								
T-71				25.6						95.1								
T-72				26.1						93.6								
T-73				27.6						91.6								

* See Test Curves

**Field moisture test, speedy method



PROJECT: BFI - S. Brunswick, NJ Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	REMARKS	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAxIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-74		Dark gray micaceous organic silty fine		27.3					92.7									
T-75		sandy clay		29.0					90.6									
T-76				28.0					93.4									
T-77				28.5					84.0									
T-78				28.6					85.6									
T-79				28.7					90.8									
T-80				28.2					91.2									
T-81				25.0					97.4									
T-82				24.9					88.2									
T-83				27.8					93.5									
T-84				25.1					94.3									
T-85				26.9					93.0									
T-86				27.2					91.0									
T-87				27.7					92.4									
T-88				28.1					88.6									

* See Test Curves



PROJECT: BFI - S. Brunswick, NJ Field Testing Program

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SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No	DEPTH (feet)	REMARKS	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CIU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-89		Dark gray micaceous organic silty fine sandy clay		28.9					91.5									
T-90				28.5					91.8									
T-91				26.6					95.3									
T-92				28.6					91.8									
T-93				28.7					92.9									
T-94				28.3					94.0									
T-95				26.3					99.0									
		end, initial data sum- mary report, 11/13/84																

* See Test Curves



PROJECT: BFI - S. Brunswick, NJ Field Testing Program

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SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST	CONSOLID.	TRIAxIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-96		Dark gray micaceous organic silty fine sandy clay		25.0					96.5									
T-97				27.6					92.5									
T-98				29.3					93.3									
T-99				28.2					93.2									
T-100				27.2					92.8									
T-101				26.9					91.2									
T-102				27.2					93.9									
T-103				28.2					93.2									
T-104				27.5					92.5									
T-105				28.1					93.3									
T-106				29.6					90.2									
T-107				28.3					93.1									
T-108				27.8					93.5									
T-109				32.8					85.5									
T-110				29.3					91.3									

* See Test Curves



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BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-111		Dark gray micaceous organic silty fine sandy clay		28.4					91.0									
T-112				29.1					90.5									
T-113				28.4					88.8									
T-114				27.6					94.8									
T-115				26.0					95.2									
T-116				25.2					96.3									
T-117				75.0					67.9									
T-118				25.6					97.3									
T-119				26.9					93.2									
T-120				15.1					110.7									
T-121				27.8					94.6									
T-122				25.8					96.8									
T-123				26.3					95.8									
T-124				25.3					98.9									
T-125				27.2					95.8									

* See Test Curves



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BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAxIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CIU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-126		Dark gray micaceous organic silty fine sandy clay		27.5					103.3									
T-127				26.6					79.8									
T-128				23.5					97.0									
T-129																		
T-130																		
T-131																		
T-132																		
T-133																		
T-134				33.0					84.8									
T-135				27.7					93.6									
T-136				29.8					91.5									
T-137				33.4					86.5									
T-138				32.1					88.1									
T-139				30.1					89.5									
T-140				28.1					91.6									

* See Test Curves



PROJECT: BFI - S. Brunswick, NJ Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAxIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-141		Dark gray micaceous organic silty fine sandy clay		27.6					95.8									
T-142				31.4					92.1									
T-143																		
T-144																		
T-145																		
T-146				32.0					90.2									
T-147				34.4					85.6									
T-148				26.1					96.3									
T-149				31.2					92.2									
T-150				32.8					87.0									
T-151				27.7					94.6									
T-152				30.9					89.9									
T-153				29.0					92.8									
T-154				27.0					93.6									
T-155				27.3					94.0									

* See Test Curves



PROJECT No. 84C2074

Woodward-Clyde Consultants

Woodward-Clyde Consultants

A-12

PROJECT: B.F.I. S. Brunswick New Jersey

Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-160		Retest of T-147	24.4						100.5									
T-161			29.5						98.4									
T-162		Retest of 138	27.4						100.9									
T-163		Retest of 137	27.5						99.3									
T-164		Retest of T-70	24.7						101.6									
T-165		Retest of T-70	27.4						98.1									
T-166		Retest of T-150	25.6						97.2									
T-167			25.8						102.5									
T-168			26.1						100.9									
T-169			21.1						105.8									
T-170			22.5						100.9									
T-171			29.5						97.2									
T-172			31.7						93.0									
T-173			29.2						98.2									
T-174			25.0						101.5									

* See Test Curves



PROJECT: B.F.I. S. Brunswick New Jersey

Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-175		Dark gray micaceous organic silty fine sandy clay		28.8					98.4									
T-176				26.2					98.4									
T-177				23.3					104.1									
T-178				24.6					103.8									
T-179				27.6					96.7									
T-180		Retest of T-134		28.8					96.7									
T-181		Retest of T-127		31.5					97.3									
T-182		Retest of T-117		27.9					97.2									
T-183		Retest of T-120		26.5					100.9									
T-184				25.1					102.8									
T-185				28.8					99.1									
T-186				22.6					106.9									
T-187				22.6					104.5									
T-188				23.4					102.9									
T-189				24.4					102.8									

* See Test Curves

PROJECT: B.F.I. S. Brunswick New Jersey

Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
T-190		Dark gray micaceous organic silty fine sandy clay		29.4					98.5									
T-191				28.8					95.0									
T-192				28.8					99.9									
T-193				26.2					100.9									
T-194				24.1					94.5									
T-195				25.0					100.6									
T-196				24.8					98.7									
T-197				24.8					101.2									
T-198				26.4					101.3									
T-199				24.8					99.1									
T-200				26.5					99.0									
T-201				27.6					97.1									
T-202				27.8					93.1									
T-203				22.0					100.1									
T-204		Retest of T-169		25.0					101.9									

* See Test Curves



PROJECT: B.F.I. S. Brunswick New Jersey Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
SS-1-7		SS-1 through SS-7 had extremely low % MC		2-3					79.0									
SS-8		(2-3%) they were retested		26.2					102.4									
SS-9		after desicated surface was watered (SS-8 to		28.0					94.4									
SS-10		SS-13)		27.6					94.4									
SS-11				29.0					94.9									
SS-12				24.8					94.6									
SS-13				25.2					95.1									

* See Test Curves

SS = Surface Sampling



Appendix B

PROJECT: BFI - S. Brunswick, NJ

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	REMARKS	SPECIAL TESTS (1)	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
ST-1		Dark gray micaceous organic silty fine sandy clay	1.37	27.2	42	25			95.9									
ST-2			0.90	24.5	39	21			98.5									
ST-3		retested, see ST-15																
ST-4			5.50	19.9	39	21			105.4									
ST-5			0.82	27.0	39	21			95.9									
ST-6			0.61	28.2	44	23			96.7									
ST-7			0.31	27.6	44	28			96.1									
ST-8			0.93	33.1	48	28			88.1									
ST-9			0.58	26.5	42	25			97.2									
ST-10			0.45	28.5	44	23			94.9									
ST-11			1.30	28.1	41	24			93.5									
ST-12			0.39	23.2					97.0									
ST-13			0.19	24.9	30	18			100.6									
ST-14			0.21	27.1	41	24			96.4									
ST-15			0.36	25.6	44	25			97.5									

* See Test Curves

(1) Coef. of Permeability K, $\times 10^{-7}$ cm/sec

PROJECT: BFI - S. Brunswick, NJ

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	REMARKS	SPECIAL TESTS (1)	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
ST-16		Dark gray micaceous silty organic fine	1.18	28.2	46	25			94.2									
ST-17		sandy clay retested, see ST-24, ST-34	33.60	32.0	38	20			80.1									
ST-18		retested, see ST-23	2.09	25.5	40	23			97.5									
ST-19		retested, see ST-22	4.00	32.3	46	27			86.9									
ST-20			0.30	30.1	46	29			91.9									
ST-21			2.15	27.0	37	25			94.7									
ST-22			0.55	27.3	42	29			93.9									
ST-23			1.07	26.8	41	24			94.0									
ST-24		retested, see ST-34	3.30	29.7	44	26			90.0									
ST-25			0.55	30.0	43	26			92.0									
ST-26			0.24	28.5	43	26			93.0									
ST-27			0.27	27.8	44	25			95.0									
ST-28			1.90	28.5	42	25			92.8									
ST-29		retested, see ST-38	4.00	28.7					90.6									
ST-30			0.83	25.7					97.8									

* See Test Curves

(1) Coef. of Permeability K, $\times 10^{-7}$ cm/sec

PROJECT: BFI - S. Brunswick, NJ

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	REMARKS	SPECIAL TESTS (1)	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
ST-31		retested, see ST-34	3.70	30.2					87.2									
ST-32		retested, see ST-36	1.92	29.0					91.8									
ST-33			0.73	28.2					93.0									
ST-34			1.20	30.9	41	28			91.2									
ST-35			0.22	27.5					96.3									
ST-36			1.55	27.5	42	24			90.9									
ST-37			0.17	26.8	48	26			96.9									
ST-38			0.30	27.7	45	26			96.7									
		End, initial data sum- mary report, 11/13/84																

* See Test Curves

(1) Coef. of Permeability K, $\times 10^{-7}$ cm/sec

PROJECT: BFI - S. Brunswick, NJ Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS (1)	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	C _U	CELL PRESSURE (psi)	BACK PRESSURE (psi)
ST-39			0.777	29.7					93.5									
ST-40			0.534	26.9					95.9									
ST-41			0.472	29.6					92.3									
ST-42			1.61	29.8					90.7									
ST-43			0.23	27.7					95.4									
ST-44			0.287	29.0					92.3									
ST-45			0.245	29.7					93.1									
ST-46			0.32	30.2					91.9									
ST-47			1.84	30.2					90.0									
ST-48			0.62	26.0					97.4									
ST-49			2.31	28.8					90.5									
ST-50			0.526	29.6					92.6									
ST-51			0.311	27.6					95.5									
ST-52			0.207	26.4					100.3									

* See Test Curves

(1) Coef. of Permeability $K_1 \times 10^{-7}$ cm/sec

PROJECT: BFI - S. Brunswick, NJ Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS (1)	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
ST-53		Dark gray micaceous organic silty fine sandy clay	2.4	30.0					91.1									
ST-54																		
ST-55					54.0	34.0												
ST-56					44.0	25.0												
ST-57			0.21	29.8	53.0	33.0			94.2									
ST-58			1.3	27.7					97.2									
ST-59			0.62	27.2	44.0	25.0			97.9									
ST-60			0.33	27.4	53.0	32.0			97.6									
ST-61			1.4	31.6	50.0	32.0			91.5									
ST-62			0.44	28.2	50.0	31.0			95.6									
ST-63																		
ST-64			38.0	31.9	54.0	31.0			93.1									
ST-65			0.67	30.8	53.0	28.0			91.9									
ST-66			99.0	33.4					88.0									
ST-67		retest of ST-64 (1,2, 3)	2.0	28.5	52.0	30.0			94.8									

* See Test Curves

(1) Coef. of Permeability $K_1 \times 10^{-7}$ cm/sec

PROJECT: BFI - S. Brunswick, NJ Field Testing Program

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS (1)	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAxIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
ST-68		retest of ST-66	0.98	30.4	48.0	26.0			92.3									
ST-69			0.48	29.5	51.0	31.0			94.3									
ST-70		retest of ST-53 (1,2, 3)	0.85	33.3	47.0	25.0			89.3									
ST-71			0.41	28.4	50.0	32.0			95.6									
ST-72			0.56	30.0	50.0	31.0			92.4									
ST-73			0.75	31.4	49.0	23.0			91.5									

* See Test Curves

(1) Coef. of Permeability $K_1 \times 10^{-7}$ cm/sec

Appendix C

PROJECT: B.F.I. - S. Brunswick, NJ Top Soil Laboratory Test Results (4/17/85)

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS 1/2	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAxIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	C _U	CELL PRESSURE (psi)	BACK PRESSURE (psi)
S-1		Brown silty medium to fine sand (Type I sand blanket)									*							
S-2		Brown fine gravelly silty coarse to fine sand (Top Soil Material)	3.1% 6.6								*							
S-3		Brown coarse to fine sandy clayey silt (Top Soil material)	2.3% 6.1								*							

* See Test Curves

1) Organic Content 2)pH

PROJECT: B.F.I. - S. Brunswick, NJ Top Soil Laboratory Test Results, (5/21/85)

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS 1/2	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST.	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
BAG		Light brown - beige coarse to fine									*	*						
		gravelly, silty coarse to fine sand. (Top																
		soil material)																
1			5.6% 4.9															
2			6.8% 4.6															
3			6.2% 4.6															
4			- 4.8															

* See Test Curves

1) Organic Content 2) pH



PROJECT: B.F.I. - S. Brunswick, NJ Top Soil Laboratory Test Results (6/13/85)

PROJECT No. 84C2074

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH (feet)	CLASSIFICATION	SPECIAL TESTS 1/2	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT. MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	CU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
BOX- BAG		Tan silty clayey coarse to fine sand, Trace fine gravel (Top soil)																
BAG			8.3% 6.6	83.1														
BOX (Top)			1.4% 6.2	15.1								*	*					
BOX (Btm)			1.4% 6.1	15.2														

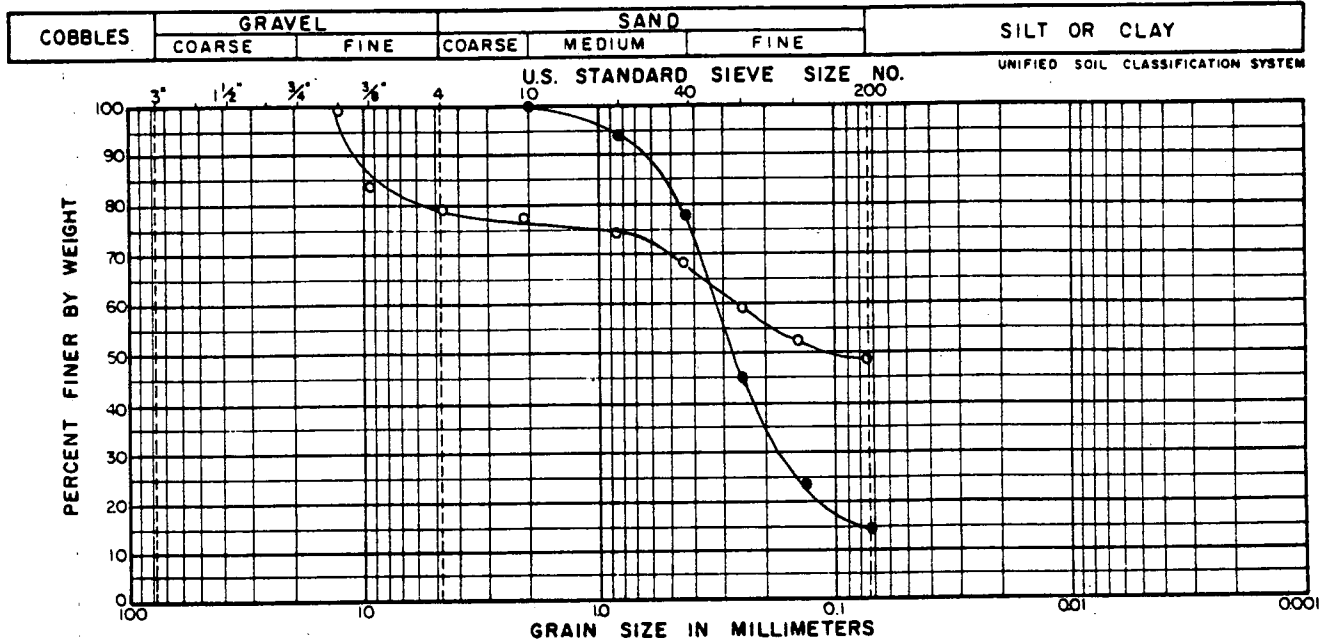
* See Test Curves

1) Organic Content 2) pH

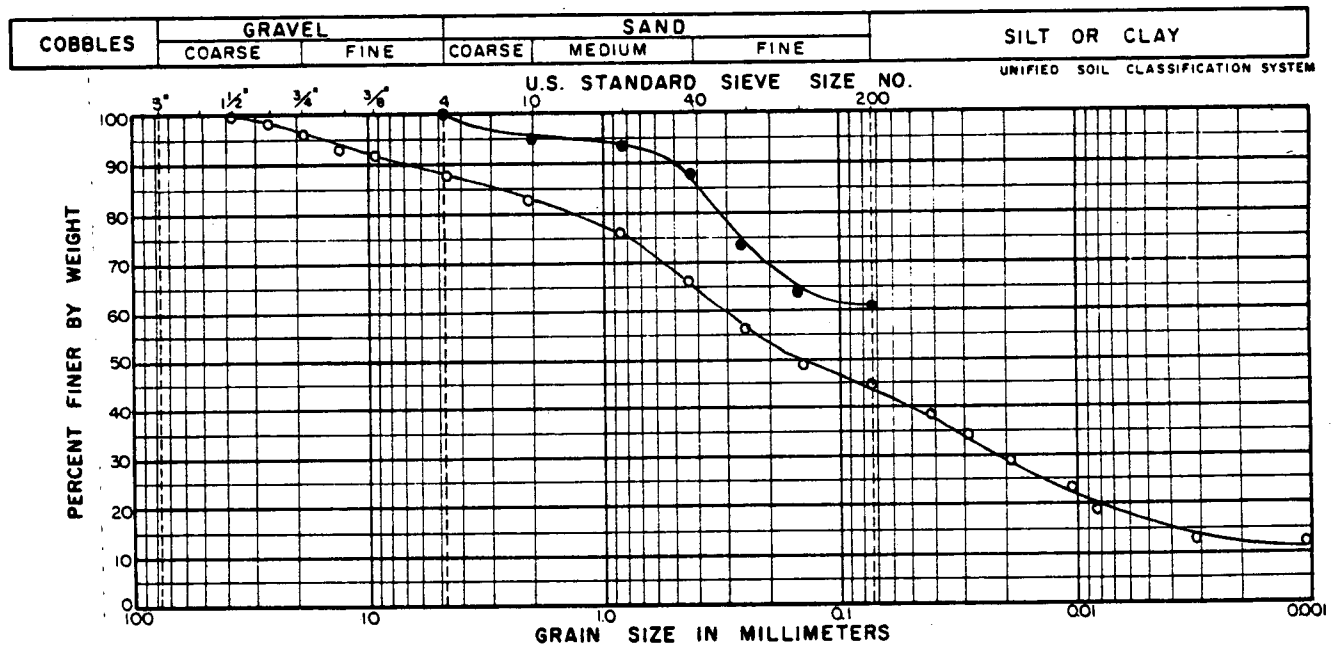


GRADATION CURVES

PROJECT NO.: 84C2074



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
S-1			•	Brown silty medium to fine sand			
S-2			◦	Brown fine gravelly silty coarse to fine sand			



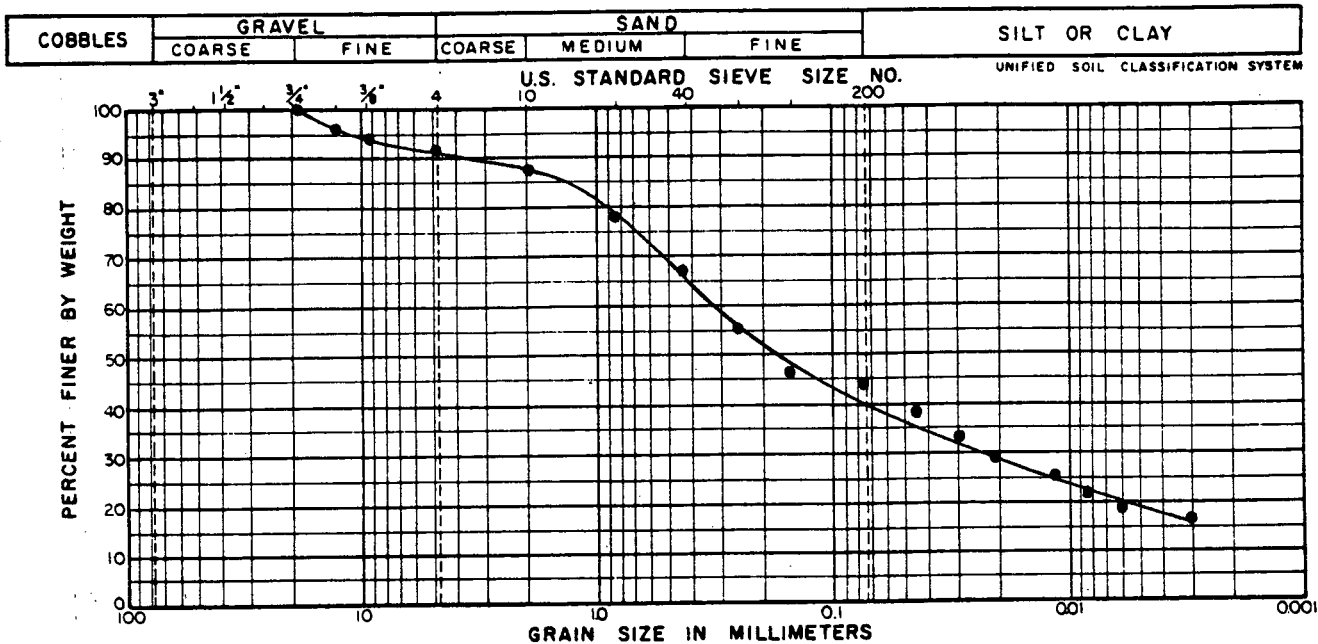
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
S-3			•	Brown coarse to fine sandy clayey silt			
BAG			◦	Light brown-biege coarse to fine gravelly silty coarse to fine sand			

PROJECT:

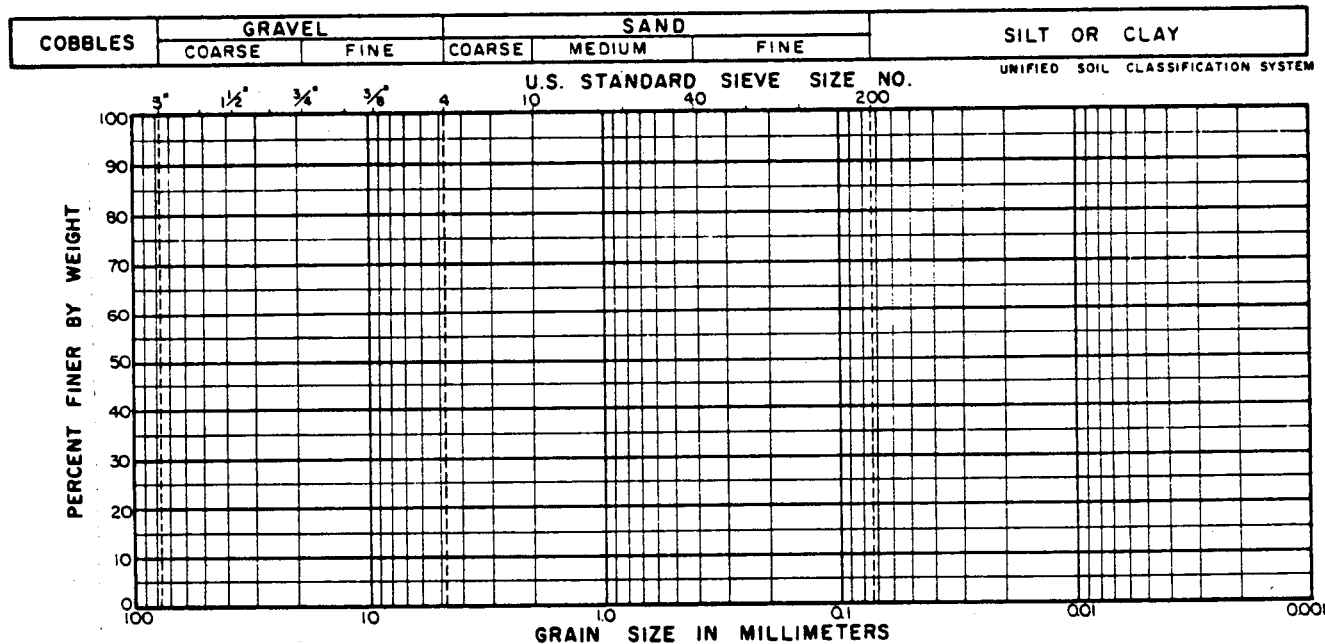


GRADATION CURVES

PROJECT NO.: 84C2074



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
BOX				Tan silty clayey coarse to fine sand; trace fine gravel			



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL

PROJECT: